

REMARKS

A. Status of the Claims.

This paper is submitted in response to the Office Action mailed August 8, 2006. Claims 1,2 4-12, 14-16, 18-22, 24-31 and 33-40 are pending and stand rejected. New claims 41-44 are added. Reconsideration of the non-final rejection is requested.

B. Allowability Withdrawn.

As a preliminary matter, Applicant notes that the previously-indicated allowability of claims 3, 13, 14, 19, 20, 23 and 32 is withdrawn in the current Office action in view of the newly discovered reference to McGibney US 5,889,759. In the present response, claim amendments that were made in the last response to place the case in condition for allowance based on the earlier indication of allowability are essentially “reversed” so as to revert those claims (apart from current amendments) to their previous condition. In that regard, canceled claims 3, 13, 23 and 32 are reintroduced in this response as “new” claims (see 37 CFR Section 1.121(c)(5)), numbered 41-44. (Claim 17 was canceled earlier and is not reintroduced here.)

C. Section 101 Claim Rejections

Claims 30, 31 and 33-40 were rejected under Section 101 as directed to non-statutory subject matter. Applicant respectfully traverses the rejection for the following reasons. As currently amended, claim 30 recites:

“30. (currently amended) A machine-readable medium having code stored thereon which defines an integrated circuit (IC), said IC comprising:

a system-level drift calculation logic to calculate an average drift amount for each multimedia signal in a first group of multimedia signals; and_a system-level drift correction logic to correct drift of each of said first group of multimedia signals based on said average drift amount.”

Thus the machine-readable medium of claim 30 stores a coded definition or design for making an integrated circuit (IC) product. The Specification explained:

“It is also important to note that the apparatus and method described herein may be implemented in environments other than a physical integrated circuit (“IC”). For example, *the circuitry may be incorporated*

into a format or machine-readable medium for use within a software tool for designing a semiconductor IC. Examples of such formats and/or media include computer readable media having a VHSIC Hardware Description Language (“VHDL”) description, a Register Transfer Level (“RTL”) netlist, and/or a GDSII description with suitable information corresponding to the described apparatus and method.” [00212]

Unquestionably, an *integrated circuit* actually fabricated according to that stored code of claim 30 would be patentable subject matter. A machine-readable medium storing that code should be deemed statutory subject matter as well, as that physical object is a tangible embodiment of the invention.⁵ It is well known that many functions can be implemented interchangeably in hardware or software. See *In re Alappat*, 33 F.3d 1526, 1583 (Fed. Cir. 1994, en banc):

Whether an inventor calls the invention a machine or a process is not nearly as important as the invention itself. Thus, the inventor can describe the invention in terms of a dedicated circuit or a process that emulates that circuit. Indeed, the line of demarcation between a dedicated circuit and a computer algorithm accomplishing the identical task is frequently blurred and is becoming increasingly so as the technology develops. In this field, a software process is often interchangeable with a hardware circuit.

In the present application, it is submitted that there is likewise a duality between an integrated circuit (unquestionably patentable subject matter) and a “machine-readable medium having code stored thereon which defines [that] integrated circuit (IC).” For these reasons, the rejection of claims 30, 31 and 33-40 under Section 101 should be reconsidered and withdrawn.

D. Section 103 Claim Rejections

1. Claims 1, 2, 12, 21, 22, 30 and 31 were rejected as being unpatentable over Ohkubo et al. (US 6,151,369) in view of McGibney (US 5,889,759). Office action page 3. Applicant respectfully traverses the rejections for the reasons explained below and requests reconsideration. While there are many differences between the present claims and the prior art of record, perhaps the most fundamental one, and the reason all of these rejections should be reconsidered and withdrawn, is that both Ohkubo and McGibney operate specifically on OFDM sub-

⁵ Indeed, that machine-readable hardware definition would be far more commercially valuable than a single IC embodiment.

carrier signals; the present invention does not. A single transmission signal comprising multiple sub-carriers, i.e., an OFDM signal, is quite different from receiving multiple individual signal carriers as in the present invention. For these reasons, and those explained below, these rejections should be reconsidered and withdrawn.

A. What is OFDM?

Orthogonal frequency-division multiplexing (OFDM) —is based upon the principle of frequency-division multiplexing (FDM), but is utilized as a digital modulation scheme. The bit stream that is to be transmitted (one bit stream), is split into several parallel bit streams, typically dozens to thousands. The available frequency spectrum is divided into several sub-channels, and each low-rate bit stream is transmitted over one sub-channel (by modulating a sub-carrier using a standard modulation scheme, for example PSK, QAM, etc.). The sub-carrier frequencies are chosen so that the modulated data streams are orthogonal to each other, meaning that cross-talk between the sub-channels is eliminated.

Put another way, “OFDM works by sending many frequency multiplexed, narrow band signals (subcarriers) together to form a wide band, high speed radio link. Frequency synchronization is required so that the closely spaced narrowband signals are not frequency shifted into a position where they interfere with each other. Timing recovery is needed to position the signal in the optimum sampling window and to make sure the phases of the subcarriers are properly aligned.” McGibney at 1:12-18 (discussed below)⁶.

B. Ohkubo’s Receiver Requires OFDM Signals.

Ohkubo concerns a single channel receiver – which uses OFDM to divide the signal across many sub-carriers. According to Ohkubo:

“To control the oscillation frequency of a local oscillator, a digital broadcast receiver demodulates a phase-reference symbol contained in an orthogonal frequency-division multiplexed [OFDM] broadcast signal to obtain an array of complex values,” and from those values it calculates a frequency offset from the difference values. (See ABSTRACT.) In other words, the local oscillator frequency

offset is determined from special phase-reference symbols embedded in the OFDM frames for that purpose. The receiver of Ohbuko thus depends and operates entirely in reliance on those phase-reference symbols provided by the transmitter in the OFDM signals:

“The invented method tunes the oscillation frequency of a local oscillator in a digital broadcast receiver by receiving a QPSK-OFDM broadcast signal and demodulating, from the received signal, a phase-reference symbol with known values $z_{\cdot \text{sub} \cdot k}$, thus obtaining an array of complex-valued frequency-domain data $X'(\omega_{\cdot \text{sub} \cdot k})$ where k varies over a range of integers and the $\omega_{\cdot \text{sub} \cdot k}$ are subcarrier frequencies.” Ohbuko at 1:47-53. Ohkubo’s claim 1 preamble confirms the subject matter of that patent:

“1. A method of tuning an oscillation frequency of a local oscillator to receive a QPSK-OFDM signal with subcarrier frequencies $\omega_{\cdot \text{sub} \cdot k}$, where k ranges over a set of consecutive integers in subcarrier frequency order, having a phase-reference symbol with known data $z_{\cdot \text{sub} \cdot k}$, where $z_{\cdot \text{sub} \cdot k}$ is encoded in subcarrier $\omega_{\cdot \text{sub} \cdot k}$, comprising ...”.

Ohkubo also is distinguished from Applicant’s claims also because it adjusts the frequency of a mixer (3) that down-converts the RF signal to an intermediate frequency signal. Ohbuko at 4:1-3. Applicant’s invention relates to frequency drift correction in a carrier removal circuit after sample streams have been converted into the time domain. See FIGS. 2a-2b, 4.

C. McGibney is a closed-loop OFDM system.

McGibney takes a somewhat different approach to synchronization, but again relying on OFDM like Ohbuko. McGibney criticizes prior solutions thus: “Most OFDM systems use a pilot tone to provide a frequency reference for the terminal⁷. This not only adds to the bandwidth and power of the transmitted signal but is also susceptible to multipath fading.” McGibney at 1:40-44. Instead, McGibney teaches:

A synchronization method uses the same signal that carries the data to simultaneously carry synchronization information (without reducing the data rate) and uses the same receiver that decodes the data to

⁶ References herein to patents take the form “column:line number(s).” For example, “1:12-15” refers to column 1, lines 12-15.

⁷ McGibney refers to a “terminal” in the context of a wireless LAN as the portable device, a “wireless terminal” that communicates with a “base station”.

simultaneously measure synchronization errors. According to a further aspect of the invention, a single voltage controlled crystal oscillator (VCXO) at the wireless terminal provides a frequency reference for both the RF oscillators and the digital sampling clock in the receiver. A corresponding crystal in the base station may act as a time and frequency standard for all the terminals in the local cell. Terminals estimate the timing error between themselves and the base station from the received signal and then adjust their reference oscillators to eliminate it. McGibney at 1:22-35.

Thus McGibney, working in the context of a wireless LAN, depends on closed loop communication with the base station (rather than special embedded symbols), as a “corresponding crystal in the base station may act as a time and frequency standard for all the terminals in the local cell. According to McGibney’s closed-loop system, “When the feedback loop synchronizes the timing [to the base station oscillator], frequency synchronization is also obtained since the RF oscillators [in the terminal] share the same reference VCXO as the sampling clock. This technique allows the system to maintain frequency synchronization without explicitly measuring the frequency offset.” Id. at 1:35-40. Applicant’s receiver does not rely on a feedback loop with the transmitter for synchronization.

D. The Examiner’s Grounds for Rejection.

The Examiner points to Ohkubo at 3:2, and at 4:34-38 which plainly confirm the discussion above; i.e., that the circuitry shown in Ohkubo (logic 14a-14d, 13a-13d) actually do NOT “calculate an average drift amount among said multimedia signals” as the Examiner posits. The Examiner clearly acknowledges that he relies on OFDM sub-carriers as grounds for rejecting these claims. See Office action, page 3. In regards to McGibney, the Examiner cites as a “carrier detection module” item 58 in Fig. 1, namely the OFDM Receiver. The present claims are not obvious in view of the applied prior art for the following reasons.

E. Applicant’s Claims 1, 2, 12, 21, 22, 30 and 31.

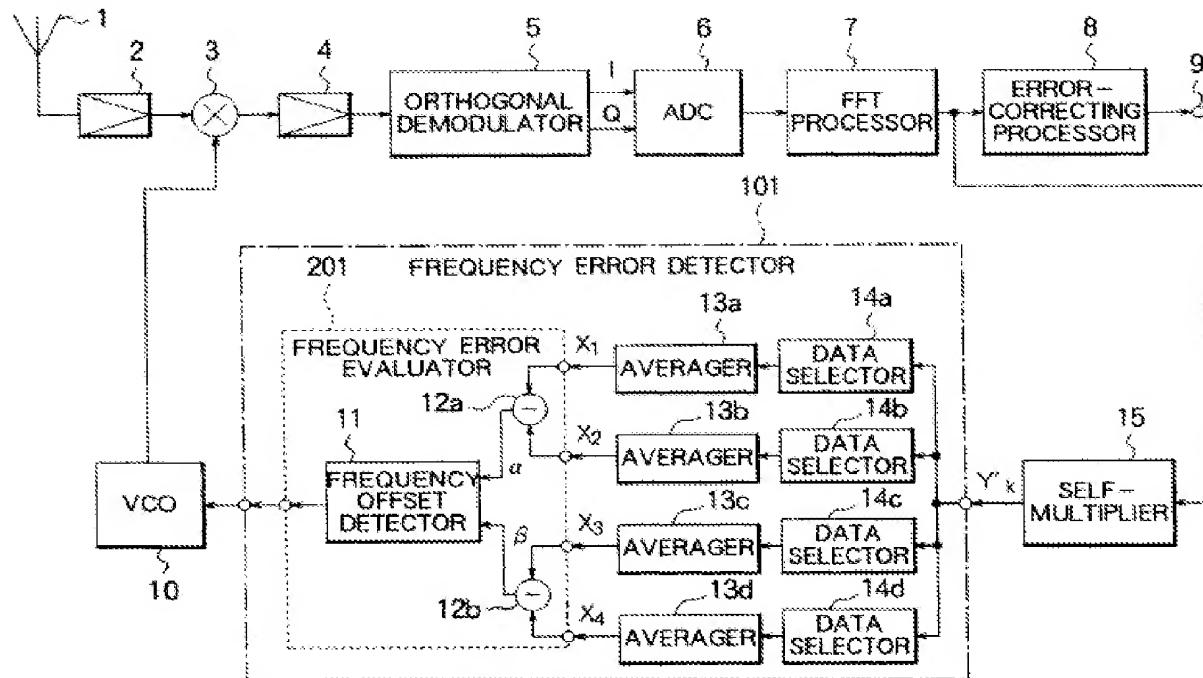
Applicant’s claims 1, 2 and 41 are each directed to “a multimedia receiver system which provides drift compensation for a plurality of different satellite transponder signals or cable/broadcast signals (multimedia signals) received over a common low-noise block downconverter (LNB).” In these claims, each multimedia signal thus carries corresponding “content” (e.g., a multimedia stream), as distinguished from the sub-carriers of an OFDM scheme that each carry “bits and pieces” of the same content signal. Similarly, claim 12 calls for “a carrier analysis

module to measure a signal characteristic of each of a plurality of satellite transponder signals or cable/broadcast signals (carrier signals) provided by a common LNB.” Claim 21 is directed to a method, “for correcting drift for a plurality of different multimedia signals comprising: calculating an average drift amount for each multimedia signal in a first group of multimedia signals...” etc. (emphasis added). These “multimedia signals” are not OFDM sub-carriers as in the prior art cited by the Examiner.

Applicant’s claimed system clearly does not require OFDM signals and it does not rely on phase-reference symbols included in OFDM frames for doing frequency offset calculation. Also, unlike McGibney, the present invention does not rely on a closed-loop system such as a wireless LAN for synchronization to a time base on a base station. As noted early in the specification, the field of the present invention “relates to a multimedia system capable of concurrently demodulating and decoding a plurality of multimedia streams transmitted from a satellite or a cable network.” [0001] (emphasis added.) These broadcasts are unidirectional; there is no feedback loop as in wireless LAN systems or telecom systems.

The “QPSK-OFDM” broadcasts received in Ohkubo comprise one broadcast signal (for example a voice or other digital data stream), which is split up into numerous parallel bit streams. Each of those bit streams is transmitted over a different frequency, and the streams are re-assembled in the receiver. “QPSK-OFDM broadcasts have multiple subcarrier signals, on which data are transmitted in parallel. Each subcarrier signal is modulated separately [QPSK], then the modulated subcarriers are combined and up-converted to the broadcast frequency to create the

QPSK-OFDM broadcast signal." Ohkubo at 1:12-15.



As shown in FIG. 1 above, one antenna receives the signal, and the orthogonal demodulator 5 recovers one I-Q pair of baseband signals.

Applicant's claim 1, by contrast, is directed to correcting frequency drift across a plurality of different broadcast signals from a common Satellite Dish (LNB) for example. Each signal is input to its own quadrature tuner, as illustrated in Applicant's FIG. 2a shown below. The present invention pertains to improved frequency adjustments for receiving and, "concurrently processing content from multiple transponders and/or QAMs" (paragraph [0010], emphasis added) in a manner that reduces cost by sharing portions of the receiver system across multiple signals. Thus the present invention is directed to concurrent demodulation of multiple different carrier signals, rather than receiving one signal that employs OFDM to divide it into multiple sub-carriers.

A system in accordance with the present disclosure reduces cost by sharing certain hardware across the multiple different carrier signals received from a common satellite dish or cable source, as illustrated by way of example in Fig. 2a:

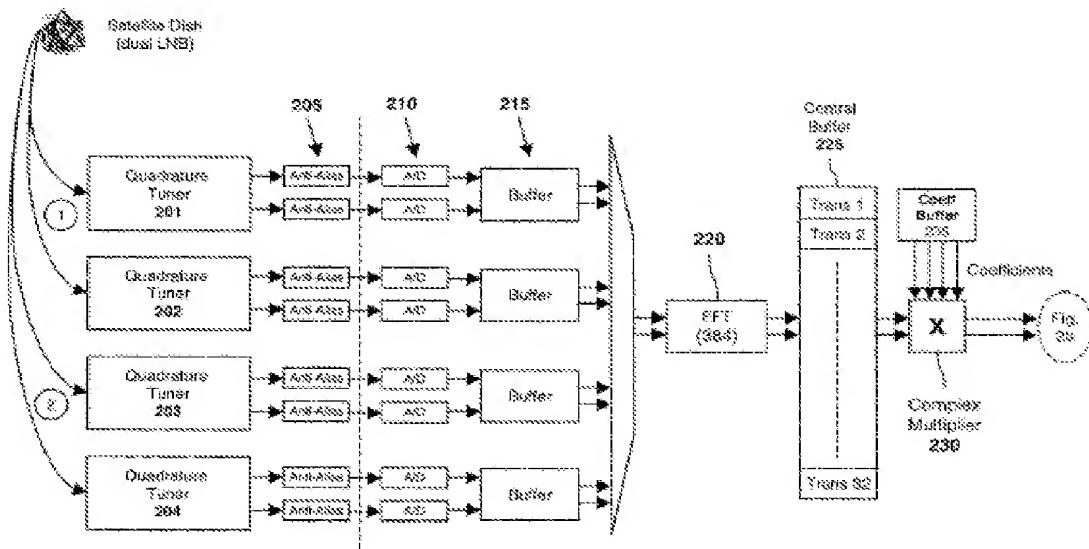


Fig. 2a

In the example of Fig. 2a, note the Satellite Dish has two LNB's (low noise block downconverters), each one providing a pair of carrier signals to a corresponding Quadrature Tuner (201-204). Thus, each LNB provides a group (in this case two) of different carrier signals to separate tuners. Note circled references 1and 2 indicating first and second groups of carrier signals, each corresponding to a respective LNB. Each transponder or carrier has its own nominal or optimal frequency value.

In the context of the present application, multiple different carriers are received. Each carrier has its own tuner (201-204 in Fig. 2a) and its own frequency. Paragraph [0039] discloses:

“As illustrated in FIG. 2, one embodiment of the invention is comprised of a plurality of quadrature tuners 201-204, each of which lock on to signals transmitted by a plurality of transponders, downconvert the signals to baseband, and separate the in-phase (“I”) and quadrature phase (“Q”) components of the signals. In one embodiment, the entire group of transponders employed on the satellite system are allocated across the tuners 201-204. Accordingly, for a 32 transponder system, each of the quadrature tuners 201-204

process data streams from 8 transponders. Two of the tuners (e.g., 201-202) process signals from the first satellite LNB and the other two tuners (e.g., 203-204) process signals from the second satellite LNB, at first and second polarizations, respectively.

The concepts of drift in receivers and closed-loop frequency tracking in general are admittedly known. What is key here, and dramatically different from the prior art, is the calculation and application of error signals averaged over multiple different carrier signals. In the illustrative embodiment of Fig. 4 below, for example, “for each carrier or baseband signal, following the linear interpolator, the signal is passed through a carrier removal module 250 which removes the carrier offset from the signal using a periodic signal (e.g., a sinusoid) supplied by a Numerically Controlled Oscillator (“NCO”) 252.” See paragraph [0058]. The detected or actual frequency for the one carrier loop shown explicitly is stored in Register 430.

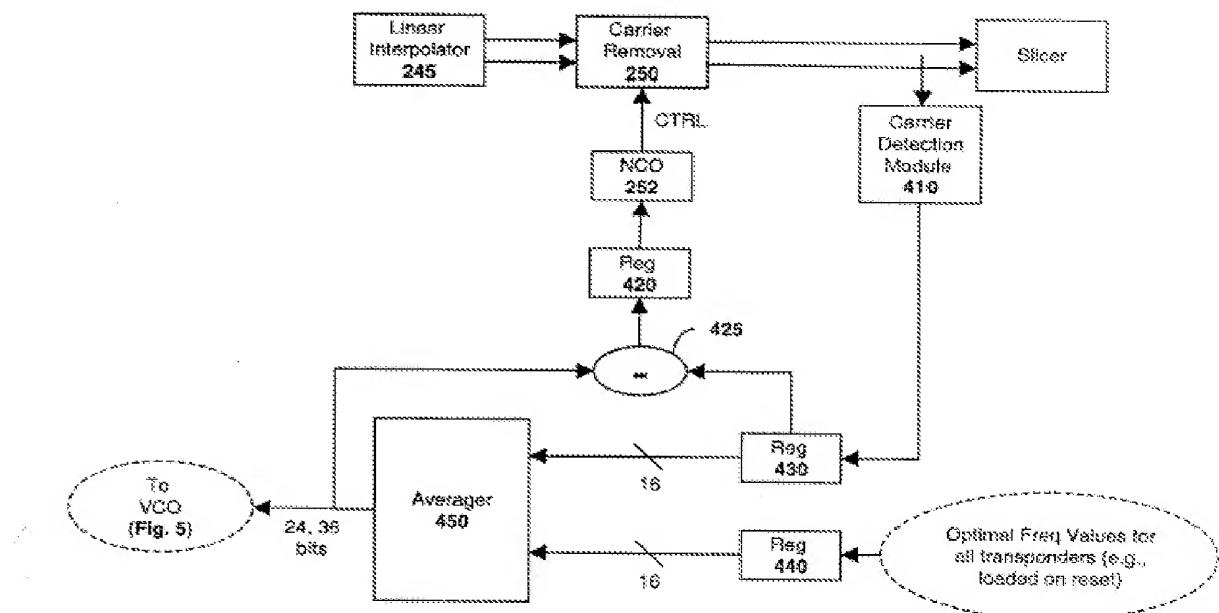


Fig. 4

The respective “Optimal Frequency Values” for all of the carriers (transponders) are stored as indicated in a Register 440. The specification explains, “To compensate for signal drift, following the linear interpolator 245, one embodiment of the invention employs the system illustrated in FIG. 4. According to this

embodiment, a carrier detection module 410 detects the frequency of the carrier signal from each transponder and stores the results in a register 430. An averager unit 450 calculates the average difference between the actual frequency signals from each transponder (read from register 440) and the desired frequency values for each transponder (i.e., assuming no drift).” See paragraph [0059].

Thus, in this example, frequency errors are calculated and averaged over a group of multiple different carriers. Finally, the averaged error signal, is provided back to the VCO of a PLL “which generates the center frequency of each of the tuners 201-204 at the front end of the receiver.” [0060]

The foregoing system and method is completely from the teaching of Ohkubo which, as noted, depends upon special phase-reference symbols embedded in the OFDM frames for frequency control. And claim 1 is clearly distinguished from McGibney’s closed-loop OFDM system as explained above.

2. Claims 4, 16, 18, 24, 25, 33 and 34 were rejected as being unpatentable over Ohkubo in view of McGibney and Wu et al. See Office action page 5. These claims are patentable at least for the reasons articulated above with regard to the corresponding base claims. Accordingly, these rejections should be reconsidered and withdrawn.

3. Claims **5, 7, 9, 10, 14, 19-20, 27-29, 36 and 39** were rejected as being unpatentable over Ohkubo in view of McGibney and Wu and in further view of Hagberg. Office action page 6. These claims are patentable at least for the reasons articulated above with regard to the corresponding base claims. Accordingly, these rejections should be reconsidered and withdrawn.

4. Claims **11 and 40** were rejected as being unpatentable over Ohkubo in view of McGibney and Crawford. These claims are patentable at least for the reasons articulated above with regard to the corresponding base claims. Accordingly, these rejections should be reconsidered and withdrawn.

5. Claims **6, 8, 26, 35 and 37** were rejected as being unpatentable over Ohkubo in view of McGibney and van Driest. Office action page 8. These claims are patentable at least for the reasons articulated above with regard to the

corresponding base claims. Accordingly, these rejections should be reconsidered and withdrawn.

New claims 41-44 are not truly new; they reintroduce canceled claims 3, 13, 23 and 32, respectively. Those claims were canceled in reliance on the earlier indication of allowability, now withdrawn. They are believed allowable

For the foregoing reasons, the pending claims should be allowed. The undersigned would welcome a telephone call for the Examiner to discuss any issues that might remain.

Respectfully submitted,

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